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Technical Guidance Package for Polyethylene and Polypropylene Manufacturing

New Source Review Division



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Technical Guidance for Polyethylene and Polypropylene Manufacturing

THIS PACKAGE IS INTENDED FOR INSTRUCTIONAL USE ONLY

References to abatement technologies are not intended to represent minimum or maximum levels of Best Available Control Technology (BACT). Determinations of BACT are made on a case by case basis. BACT determinations are always subject to adjustment in consideration of specific process requirements, air quality concerns, and recent developments in abatement technology. Additionally, specific health effect concerns may indicate stricter abatement than required by the BACT determination.

The represented calculation methods are intended as an aid in the completion of acceptable permit applications; alternative calculation methods may be equally acceptable if they are based upon, and adequately demonstrate, sound engineering assumptions or data.

These guidelines are applicable as of the date of publication of this document, but are subject to revision during the permit application preparation and review period. It is the responsibility of the applicants to remain abreast of any guideline or regulation developments that may affect their industries.

The special conditions included with these guidelines are for purposes of example only. Special conditions included in an actual permit are written by the reviewing engineer to address specific permit requirements and operating conditions.

This document was developed specifically for polyethylene and polypropylene manufacturing process units. This document is intended to help streamline the TNRCC permitting process and decrease the time required for a permit review. Remembering that all representations made in a permit application become conditions upon which a permit is issued, amended, or renewed is important.

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I. OVERVIEW

The purpose of this document is to help the permit applicant in planning air pollution abatement methods, and in preparing a permit application for a project to build or modify polyethylene or polypropylene manufacturing units. This includes all continuous manufacturing processes that produce polyethylene, polypropylene, or their copolymers. Staff of the Texas Natural Resource Conservation Commission (TNRCC) will also use this document as a reference.

A typical process description is presented and the basic technology discussed. Specific process design is often unique to the facility being reviewed as these types of processes can produce low or high density products in low or high pressure, gas, solution, or slurry processes. Operations in the processes with the potential to cause air emissions are identified and pollutants discussed. State and federal regulations are identified, however, there may be other potentially applicable requirements that the source must consider. The federal New Source Performance Standards (NSPS) for these types of processes are comprehensive if triggered by the modification.

The specific emission points are discussed with the control or process technologies required to meet BACT for the emission point. The main sources of facility air emissions include volatile organic compound (VOC) emissions from unreacted monomer, solvent and additives, and particulates from the polymer product.

The calculations for emission estimates in this package are largely based on equipment specifications, test results, and mass balances. The typical permit conditions are dependent on the emission testing required and control technology proposed.

II. DESCRIPTION

The polymer facilities covered by this technical guidance package use ethylene or propylene feedstocks to produce polyethylene or polypropylene. Another monomer may be added to the reaction to produce a copolymer. The processes used for this operation vary and the process technologies are still being modified. NSPS Subpart DDD, Standards of Performance for VOC emissions from the Polymer Manufacturing Industry, provide the process categories listed below:

Process types:

polyethylene low density high pressure

low pressure

high density gas phase

liquid phase solution

polypropylene liquid phase (slurry)

gas phase

The processes have some general similarities, but the process designs for these types of polymer facilities are evolving so the specifics can be significantly different. A generic, simplified polymer

process block diagram is shown on the following page for reference. A typical liquid phase slurry, high-density polyethylene process is described in some detail below. Some major differences between that and other processes are described in the subsequent paragraphs.

The monomer (ethylene) and comonomer (if used) are preconditioned (water and other impurities removed) and directed to the reactor with an activated catalyst. Polyethylene particles are formed in a diluent (recycled isobutane)/polymer slurry. Other additives may be present to control the polymer molecular weight, reduce static charge, or to act as a co-catalyst.

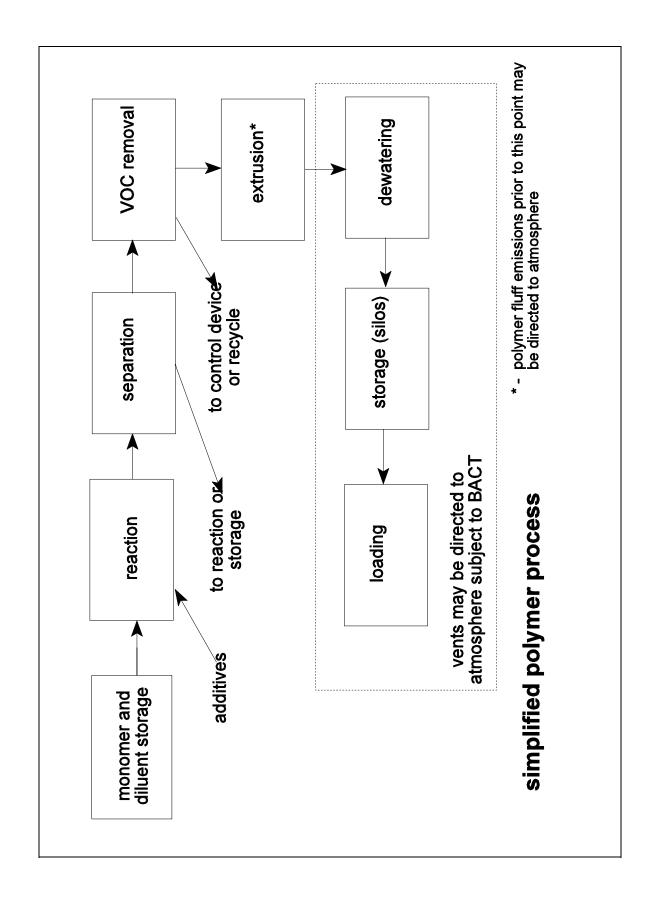
The slurry stream flows from the reactors through steam heaters to the flash chambers where the light materials are separated. The flashed gas is separated, diluent and comonomer are recycled, while the remaining stream is combusted. The polymer "fluff" is purged with hot nitrogen gas (or steam) to remove residual vapors. The nitrogen purge gas is recycled and is bled to a flare. In some cases, the fluff may be taken as a product.

If not used as a product, the fluff is transported with nitrogen or air to an extruder feed tank. The extruder melts the polymer and pelletizes it. In some cases, the fraction of residual vapors in the polymer at this point in the process defines the VOC emission rate from the finishing and storage portion of the process. If fluff was taken as a product, or was vented directly to atmosphere prior to the extruder, it would need to be sampled for residual VOCs to determine process emissions. The pellets from the extruder are cooled in water, then dewatered, dried, and stored in ventilated silos. The vents downstream of the extruder have particulate control devices and are usually directed to atmosphere.

The polymer product, as fluff or pellets, is loaded into bags, trucks, or railcars. The particulate emissions are controlled by directing the vents to a control device. The generic description for the gas phase process is similar to that above; the solvent used may change and different product characteristics are possible (particles/powder rather than fluff).

Low density polyethylene (LDPE) generally has more branched polymer chains and a lower density. The high pressure reaction takes place in the liquid phase at pressure greater than 20,000 psig so that multiple compression and separation steps are necessary. Parts of the process are sometimes inaccessible during operations and the high pressure results in high residual VOC concentration in the polymer produced. The low pressure process (<500 psig) can be gas phase or a solution process and employs a proprietary catalyst. The LDPE polymer produced from these processes can be in pellet or granular form.

A typical polypropylene slurry process is similar to the polyethylene process described above. The propylene, diluent (hexane for example), and catalyst are added to parallel reactors. Methanol (or another compound) is added to the product to terminate reaction. A series of steps is used to separate the diluent, catalyst/methanol, and product. The product is dried in a closed loop system to remove residual VOCs from the polymer. The polymer is extruded into pellets and



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the rest of the processing steps are the same as described for the polyethylene slurry process.

A typical permit will cover emissions related to:

- (a) monomer/additive storage (covered by Storage Tanks Guidance Package)
- (b) piping fugitives (covered by Equipment Leak Fugitives Guidance Package)
- (c) cooling tower fugitives (covered by Cooling Towers Guidance Package)
- (d) process vents (upstream of extruder)
- (e) finishing vents (extruder and downstream to storage and loading)
- (f) polymer storage
- (g) polymer loading
- (h) wastewater (controls reviewed on case-by case basis)

This document will briefly discuss BACT and provide some sample permit conditions for emission points (a) through (c); detailed guidance for calculating emissions from these points is covered in the *Technical Guidance Packages* noted. The uncontrolled emissions from points (d) through (g) are highly dependent on the production process chosen. The process vent section also includes the equipment associated with solvent and monomer recovery and reuse. Older high pressure processes can have residual VOC in the polymer as high as 1100 ppmw, which is more than ten times greater than a well-designed low pressure process. The BACT for these emission points and emission calculations are discussed in Sections IV and VI of this document. Wastewater emissions are considered on a case-by-case basis as the control for these emissions may be common to multiple units on the site.

III. APPLICABLE STATE AND FEDERAL REQUIREMENTS

The operator must demonstrate compliance with state regulations shown below:

Opacity Limits (a)	§111.111(a)(1)
Stack Height	§111.151
PM GLCs (b)	§111.155
Tanks	§115.112 - 115.119
Process Vents (c)	§115.121 - 115.121
Wastewater (d)	§115.140 - 115.149
Loading/Unloading (e)	§115.211 - 115.219
Transport Vessels (e)	§115.234 - 115.239
Fugitive (f)	§115.332 - 115.339
. ,	§115.352 - 115.359
	Stack Height PM GLCs (b) Tanks Process Vents (c) Wastewater (d) Loading/Unloading (e) Transport Vessels (e)

In addition, the operator must also comply with Reg VI, which covers the permit application review process in general, and other regulations that may apply to the control device used for VOC emissions.

Comments on state regulations:

- (a) §111.111(a)(1) generally requires 20 percent opacity for permitted sources. For any vent having a total flow of 100,000 ACFM or greater, the required value drops to 15 percent opacity unless an opacity CEMS is installed.
- (b) §111.155 requires that particulate emissions from all sources on the site not result in an offsite particulate concentration greater than a three-hour average concentration of 200 ug/m3 or a one-hour average concentration of 400 ug/m3.
- (c) The Regulation V requirements are dependent on the area of the state where the site is with most requirements applying to facilities in ozone nonattainment counties. For liquid phase polypropylene and liquid phase slurry HDPE in nonattainment counties, vent streams require control if the VOC concentration is greater than 408 ppmv unless the VOC emissions are less than 100 pounds in any 24 hour period.

Vents at other facilities in nonattainment areas require control if the VOC concentration is greater than 612 ppmv unless it is a LDPE process with total ethylene emissions less than 1.1 lb./1,000 lb. product, or the total emissions from the vent are always less than 100 lb. in any 24-hour period, or until November 15, 1998, if the VOC concentration is less than 30,000 ppm. There are further exemptions or no requirements for counties that are in attainment with the ozone NAAOS.

- (d) §115.140 115.149 affects Dallas/Fort Worth, Houston/Galveston, and El Paso ozone nonattainment areas only. In general, it requires at least 90 percent control of VOC emissions from wastewater if the VOC concentration in the water is greater than 1,000 ppmw.
- (e) §115.211 115.219 may apply to unloading raw materials at a polyethylene or polypropylene facility. They are covered in more detail in the *Loading Operations Technical Guidance Package*.
- (f) §115.332 115.339 is applicable through November 15, 1996, and §115.352 115.359 applies after that date.

A Regulation VI, Subchapter B, review of an existing polyethylene or polypropylene facility could be triggered by a planned change in comonomer feed that would result in an increase in actual emissions of pollutants, construction to modify a unit, or a change in method of operation such as using other additives or chemicals.

The operator also must comply with any applicable federal regulations. Polymer production facilities are covered in Subpart DDD of the NSPS. Subpart DDD sets forth standards for any of the process sections (raw materials' preparation, material recovery, polymerization reaction, product finishing, and product storage) constructed, modified, or reconstructed after January 10, 1989. There is limited applicability for units constructed, modified, or reconstructed before that date. These standards:

require fugitive monitoring per NSPS VV

- do not require controls on vent streams with uncontrolled VOC annual emission rates less than 1.76 TPY, or if the VOC concentration in the uncontrolled vent stream is less than 1,000 ppmw,
- exempt emergency vent streams from control, (Emergency vent streams are defined as those necessary to prevent decomposition, installed for safety, or used to prevent equipment damage. These include releases due to power or equipment failures.)
- require controls (subject to the exceptions above) if the continuous vent is currently uncontrolled and the VOC concentration is greater than 20 wt percent or the stream volumetric flow rate is less than or equal to eight scfm, (Controls may not be necessary if an existing control device is installed to treat the vent stream, or if the emissions from that stream category do not exceed the trigger level identified in Subpart DDD. Due to the complexity of this analysis it is not reproduced here. The specific requirements may be found in Subpart DDD of the NSPS.)
- require control devices reduce VOCs by 98 percent or to 20 ppmv, or vent to a nonsmoking flare with a stable flame present, or vent to a flame zone of a boiler or process heater with a design heat input of 150 MMBtu/hr or greater,
- require intermittent emissions be controlled by venting to a flare, incinerator, boiler, or process heater, and
- do not require testing for streams controlled by flare, boiler, or process heater.

The NSPS should be consulted to ensure that the proposed facility meets all requirements as Subpart DDD is too lengthy and complex to reproduce here. There are no federal NESHAPS requirements that specifically apply to polyethylene or polypropylene facilities. Federal New Source Review permitting requirements (Prevention of Significant Deterioration [PSD] or Nonattainment New Source Review) may be triggered by increases in criteria pollutant emissions. The most likely pollutant to trigger such a review for these types of facilities are VOCs. Permit applicants should reference the *New Source Review Workshop Manual* or *Nonattainment New Source Review Guidance Manual* for assistance in interpreting the permit application requirements in these areas. These facilities are also subject to the federal NAAQS.

IV. BEST AVAILABLE CONTROL TECHNOLOGY

This section provides the BACT requirements for polymer units. It also describes how emissions are measured to estimate emission rates in the permit application and to verify compliance with the emission limits. The pollutants requiring control at polyethylene and polypropylene facilities include VOCs and particulates. Both VOC and particulate emissions are a function of the process technology used to manufacture the polymer. For example, a high pressure process will have a much higher residual monomer content in the polymer exiting the reactor than will a low pressure process. VOCs make up the bulk of the emissions from these units and are discussed. Emissions such as NOx and CO from auxiliary units associated with a permit application (boilers, for example) are not discussed. The permit applicant should refer to the appropriate guidance document if these

emissions are included in a permit application.

VOC Sources

Since all types of polymer facilities produce polymer with some level of residual VOC in the fluff or pellet, BACT for these units is based, in part, on the residual VOC in the polymer for the particular process. BACT for all types of processes includes a closed loop step before the polymer is vented directly to atmosphere (without additional VOC emission control on the vent stream) to remove and recover as much residual VOC as possible. This point in the process is generally at the extruder or after the production of fluff polymer products and must be clearly identified in the permit application. The VOC concentration in the vent streams downstream of the extruder generally is too low (<100 ppm) to be controlled without incurring a high cost. The following table provides the maximum allowable residual VOC in the polymer at the first uncontrolled vent from the unit:

Process Type	ppmw VOC in polymer*
polyethylene - high pressure	case by case**
polyethylene - solution	case by case***
polyethylene - slurry	< 100
polyethylene - gas	< 100
polypropylene - slurry	< 100
polypropylene - gas	< 100

- * The total non-fugitive emissions (including the residual VOC) from the processes should generally be less than 200 to 250 lb./MMlb. product.
- ** These units generally have residual VOC concentrations much greater than those observed in the other processes after the extruder, and would likely require additional control of the vent streams after that point in the process. The permit applicant should control these emissions until the residual in the pellet is less than 100 ppm or provide a cost estimate for control of these vent streams for use in a tier 3 BACT review.
- *** Process and cost information will be required to allow for emission rates above those shown in the table for other polyethylene processes.

Permit applicants may submit control cost estimates for use in a tier 3 (case by case) BACT review of their process if they feel the above levels are too restrictive for their facility. The residual VOCs should be determined by use of the VOC head space test or equivalent.

The VOC head space test involves taking a polymer sample and placing it in a sealed container so that any residual VOCs in the polymer may evolve from the sample over a period. The VOC in the container is measured using a gas chromatograph and the fraction of VOCs in the sample

determined. The test is done to approximate the worst case emissions from the site (longest storage time, highest temperature, etc.). This sample will be taken at or before the first vent to atmosphere and at subsequent emission points if necessary. Sampling will generally be required with each change in product type and/or weekly. Sampling frequency may be reduced based on frequency of product changes and unit operating experience. Contact the TNRCC's Office of Compliance & Enforcement, Engineering Services Section at (512) 239-1051, for example test procedures.

Dryers and other emission points should be designed with single emission stacks where practical to facilitate any stack sampling and monitoring required. Stack sampling will be required when specified by NSPS Subpart DDD (if applicable) and may be required to validate the VOC head space test method, especially where a higher molecular weight solvent (such as a C5 or greater) is used in the process.

All other emissions from the process are expected to be controlled with the devices and monitoring programs detailed below by emission type:

process vents

VOC vent streams are expected to be recycled for use in the process if possible. All VOC waste streams not recycled are generally expected to be controlled by combustion - flare, incinerator, boiler, heater, etc. Other control devices may be used (the control efficiency for ethylene and propylene is expected to be at least 99 percent) and must be able to process streams that may contain particulate matter. Refer to the appropriate technical guidance package for the control device when considering controls. The appropriate TNRCC table must be filled out and submitted for the control device; Table 8 for flares, Tables 4 and 6 for other combustion devices.

fugitive emissions

A 28VHP fugitive monitoring program is considered BACT for this type of facility. Fugitive emissions from all components (accessible and inaccessible, monitored and unmonitored) must be determined and included in the emission estimate. Credit for fugitive emission control can only be taken for those components that are accessible and monitored during operation. Refer to the Equipment Leak Fugitives Technical Guidance Package for detailed calculational guidance. Streams containing ethylene are required to use different emission factors than other VOC streams when determining fugitive emissions.

cooling water

If cooling water is used in the process, VOC emissions from the cooling water must be estimated unless the tubes and the tube sheets in the heat exchanges are welded, or the cooling water pressure in the heat exchangers is greater than the process-side pressure so that VOCs leaking to the cooling water is not possible. These emissions should be estimated using test results from the facility, if available. If no test results are available, the cooling water emissions should be estimated using AP-42 refinery cooling water emission factors unless better data is obtained. BACT and emissions calculations are covered in more detail in the *Cooling Tower Technical Guidance Package*.

abnormal/maintenance emissions

Abnormal and maintenance emissions are not normally shown on the MAERT, but must be identified as accurately as possible in the permit application. These emission estimates are not

considered maximum allowables. They are reviewed as part of the BACT determination and for potential nuisance and health impacts. These emissions are expected to be routed to a control device (generally a flare) unless it is shown that it is technically infeasible or the cost is prohibitive. In those cases, the potential release would be evaluated for off-site impacts (see Section V). There are cases, such as a fire or a decomposition reaction in a high pressure process, where it is not technically practicable to route to a control device. In these cases, the applicant should demonstrate how such releases will be minimized. The applicant is expected to provide the emission point (and release characteristics), and an estimate of the quantity and the frequency of release in all cases.

loading

Due to the low residual VOC concentration in the polymer at this point in the process and the relatively small amount of time spent loading the polymer, these emissions might be considered negligible. This must be documented by data showing the low residual monomer additive, or solvent concentration in the polymer at that point in time and the proposed loading time. Otherwise estimate using the VOC head space test referenced earlier. The BACT for uncontrolled VOC emissions is set by the maximums shown in the table at the start of the BACT section.

Particulates

These emissions can occur from the following operations: extrusion, silo storage, additive feed, additive tanks, blending, and loading. Control of these emissions is generally obtained by cyclones and baghouses and is expected to be greater than 99.9 percent or have an exhaust particulate concentration of less than 0.01 grain/scf. A table must be filled out and submitted for each particulate control device used. Examples of the tables for cyclone separators (Table 10) and fabric filters (Table 11) are attached. Other particulate control devices may be used if equivalent control efficiency is shown. If classifying the particulate by size is not possible, it should be assumed to be PM10 (diameter less than 10 microns). Loading must be done so that all particulate emissions are directed to a control device.

V. MODELING/IMPACTS REVIEW

An impacts review must be done in accordance with the document *Modeling and Effects Review Applicability Guidance Document for Non-Criteria Pollutants* when processing any permit action. Propylene is exempt from the health effects review because it is considered a simple asphyxiant. Ethylene, other comonomers, solvents, and additives will be considered in the review. If the facility is already in operation, the applicant is encouraged to provide current, actual and allowable emissions for the facility as these are often necessary to do this review. If other information or air dispersion modeling is required for the project as part of this review, it will be requested by the permit engineer.

Air dispersion modeling also may be required by federal New Source Review (PSD or nonattainment) or to verify compliance with the NAAQS. This modeling may be submitted with the application. However, delaying the modeling may be preferable until the permit engineer has verified how accurate and complete the emission rates are at the unit. This will ensure correct inputs

to the model and reduce the possibility of having to do the modeling run again. A pre-modeling meeting also may be held to ensure that correct modeling protocol is followed.

The maintenance and upset emissions identified by the applicant will be considered by the permit engineer for their potential to cause nuisance conditions or health hazards off site. The permit applicant must submit the best estimate of the discharge parameters (quantity emitted, temperature of discharge, height of discharge, velocity of discharge, location on the site, diameter of valve or stack) for each type of emission or emission point. It is not necessary for the applicant to include every possible discharge but to identify those with the greatest quantity released or those most likely to cause health hazards off site. The permit engineer will review these emissions, which may include air dispersion screen modeling, and request additional modeling or controls on the emissions if needed, though not usually required for these types of facilities.

VI. SAMPLE CALCULATIONS

For control using combustion devices, the VOC emissions are determined using the control efficiency of the unit on the stream being controlled with the uncombusted fuel source (VOC fraction) also included. Emissions of the other products of combustion (CO, NOx, particulate, and SO_2 if the fuel source contains sulfur) are calculated using test or vendor data. If these sources are unavailable, AP-42 natural gas combustion factors or TNRCC flare factors may be used, as applicable. Calculations for VOC emissions from the control device, fugitive emissions, cooling water emissions, and tank emissions are not included here; these can be found in the technical guidance packages cited earlier in this document.

Emissions from streams with low concentrations of VOC that do not allow for accurate continuous monitoring may be estimated by using the "VOC head space" (or equivalent) test to determine the amount of residual VOC in the polymer at that point in the. For example, if the product polymer has a residence time of 24 hours in the storage silos, the emissions from each pound of polymer may be determined using this test. The emissions then can be stated as the production rate times the VOCs emitted per pound of polymer as determined by the test. A similar method may be used for other emission points. It is likely that any permits issued will require periodic testing of this type to ensure that the differing product types do not violate the maximum allowable emission rate in the permit. An example is shown below:

Example 1

VOC head space sampling (annual average) from an existing polyethylene unit showed the following results (samples taken just before each emission point):

at extruder/dryer - 72 ppmw VOC at silo 51 ppmw VOC before loading 8 ppmw VOC

The existing and proposed facility (500 MMlb./yr) are similar and only three emission points are venting to atmosphere (extruder, silo, loading). The annual VOC emissions are estimated to be:

The loading estimate is very conservative as it assumes that the vessel being loaded vents to the atmosphere at the plant site for a prolonged period. The VOC emissions could also be speciated, if off-site impacts are a concern, with the diluent and monomer expected to be the major species. Sampling on the existing unit showed the maximums of VOC concentration measured throughout the year for each sample point were as much as 30 percent higher than the figures above. In addition, the maximum hourly production rate for the proposed unit could be up to 20 percent greater than the annualized average. The maximum hourly emissions are therefore:

The silo and loading emissions would be 3.83 and 0.71 lb./hr respectively.

Example 2

The loading particulate emissions are controlled by fabric filters guaranteed to reduce the particulate emissions to less than 0.01 grain/scf. The vent gas to the control device during loading is expected to be a maximum of 6800 scfm. Hourly particulate emissions are determined to be:

$$6800 \text{ scfm}^*(60 \text{ min/hr})^*(0.01 \text{ grain/scf})^*(\text{lb.}/7000 \text{ grain}) = 0.58 \text{ lb./hr}$$

Loading at this spot will occur no more than eight hours per day so the annual emissions are:

$$0.58 \text{ lb./hr*}(ton/2000 \text{ lb.})*(8760 \text{ hr/yr})*(8/24) = 0.85 \text{ TPY}$$

VII. EXAMPLE PERMIT CONDITIONS

Typical special conditions for a simplified polymer manufacturing facility are provided on the following pages. This sample permit covers a simplified new low pressure polyethylene facility. Here the first VOCs vent directly to atmosphere at the extruder. Stack testing is required at the facility due to NSPS Subpart DDD requirements and to ensure the validity of the VOC head space

testing procedure for polymer residual VOCs at the unit. Off-site concentrations of VOCs are a concern so loading emissions are quantified because they have different discharge characteristics and therefore different dispersion and off-site impacts than the bulk of the emissions.

Because each review is done on a case-by-case basis, the following conditions are not all inclusive and/or may not be included in some polyethylene and polypropylene permits. Final permit conditions will change with the specific process type, operating experience, and emission estimates. Final permit conditions will be negotiated on a case-by-case basis with each permit applicant. Editorial comments in the examples are italicized.

SPECIAL CONDITIONS Permit No.

EMISSION STANDARDS

1. The total emissions of air contaminants from any of the sources will not exceed the values stated on the attached table entitled "Emission Sources - Maximum Allowable Emission Rates."

FEDERAL APPLICABILITY

2. These facilities will comply with all applicable requirements of Environmental Protection Agency (EPA) Regulations on Standards of Performance for New Stationary Sources promulgated for Volatile Organic Liquid Storage Vessels and for VOC Emissions from the Polymer Manufacturing Industry in Title 40 Code of Federal Regulations Part 60 (40 CFR 60), Subparts A, Kb, and DDD.

PRODUCTION LIMITS

3. Annual production from the permitted unit will not exceed ### million (MM) pounds per year. The facility will produce copolymers and homopolymer subject to the hourly throughput constraints contained in the Table 2A submitted with the permit amendment application, PI-1 dated September ##, 19## (these may be listed in this permit condition).

EMISSION CONTROLS

4. <u>Carbon Compound Waste Gas Streams</u>

A. All waste gas from point sources containing VOC and/or other organic compounds (hydrocarbons and/or hydrocarbon derivatives excluding carbon dioxide) and acid gas will be routed to the control device. The control device will operate with no less than 99 percent (for flare controlling ethylene or propylene emissions, may vary with other control devices or compounds) efficiency in disposing of the carbon compounds captured by the collection system. The waste gas streams will include process vents, relief valves, analyzer vents, steam jet exhausts, upset emissions, start-up and shutdown-related

- emissions or purges, blowdowns, or other system emissions of waste gas. Any other exception to this condition requires prior review and approval by the Executive Director, and such exceptions may be subject to strict monitoring requirements.
- B. The holder of this permit will perform sampling and other testing as necessary to establish the pounds per hour of VOC being emitted into the atmosphere from the cooling tower and wastewater system associated with this permit. All sampling and testing methods will be subject to approval of the Executive Director prior to their use. The VOC concentration (ppmv) in the exhaust from the air stripping system or equivalent and the corresponding pounds of strippable VOC/gallon of cooling water should be reported. These will be used to determine the level (either ppmv or lb./VOC/gal) at which a leak into cooling water will be assumed in the ongoing monitoring program. Within 30 days after completion of sampling, copies of the test report will be submitted to the TNRCC Office of Air Quality New Source Review Program and the TNRCC regional office.
- C. The VOC associated with cooling tower water will be monitored monthly with an approved air stripping system or equivalent. The appropriate equipment will be maintained to minimize fugitive VOC emissions from the cooling tower. Faulty equipment will be repaired at the earliest opportunity but no later than the next scheduled shutdown of the process unit in which the leak occurs. The results of the monitoring and maintenance efforts will be recorded and such records will be maintained for two years. The records will be made available to the Executive Director upon request.
- 5. Flares will be designed and operated in accordance with Title 40 Code of Federal Regulations Part 60 (40 CFR 60) Section 18 including specifications of minimum heating value of the waste gas, maximum tip velocity and pilot flame monitoring. If necessary to insure adequate combustion, sufficient fuel gas will be added to make the gases combustible. An infrared monitor is considered equivalent to a thermocouple for flame monitoring purposes.
- 6. The holder of this permit will install a continuous flow monitor and an analyzer that provide a record of the vent stream flow and composition (total VOC) to the flare. The flow monitor sensor and analyzer sample points should be installed in the vent stream as near as possible to the flare inlet such that the total vent stream to the flare is measured and analyzed. The average hourly values of the flow and composition will be recorded. Records of the hourly averages will be maintained for two years and be made available to the Executive Director of the TNRCC upon request.
- 7. Supplemental fuel used in the Flare (EPN ###) will be limited to pipeline-quality sweet natural gas containing no more than five grains of total sulfur per 100 dry standard cubic feet. Use of any other fuel will require an amendment to the permit.
- 8. Total VOC emitted to the atmosphere between the extruder and hopper car loading areas (includes EPNs extruder/dryer and silo) will not exceed the value of 70 pounds of

- VOC/million (MM) pounds of high density polyethylene pellets.
- 9. Particulate matter grain loading from any vent will not exceed 0.01 grains per dscf of air.
- 10. All particulate matter (PM) filter systems will effectively capture emissions from associated equipment and prevent particulate emissions from escaping. The PM filter systems will be maintained free of holes, cracks and other conditions that would reduce the collection efficiency of the emission capture system.
- 11. The filtered vents covered by this permit will not operate unless filters and associated equipment are maintained in good working order and operating during normal facility operations. The following steps will be performed, at a minimum, to ensure proper operation of each filtered vent:
 - A. All filter vents will be inspected for visible emissions once each day.
 - B. When there are visible emissions from any one filtered vent, the operation associated with that particular filtered vent will be isolated and shut down in a timely and orderly manner. The isolated filter system will be tested and inspected. Failed or damaged parts will be repaired or replaced.
 - C. A spare-parts filter inventory will be maintained at the site for this facility.
- 12. <u>STORAGE AND LOADING OF VOLATILE ORGANIC COMPOUNDS (VOC)</u> (This condition may be limited to the tank record keeping sections unless there are a significant number of tanks in the permit.)
 - A. The control requirements specified in paragraphs B-E of this condition will not apply (1) where the VOC has an aggregate partial pressure of less than 0.5 psia at the maximum expected operating temperature or (2) to storage tanks smaller than 25,000 gallons.
 - B. An internal floating deck or "roof" or equivalent control will be installed in all tanks. The floating roof will be equipped with one of the following closure devices between the wall of the storage vessel and the edge of the internal floating roof: (1) a liquid-mounted seal, (2) two continuous seals mounted one above the other, or (3) a mechanical shoe seal. Installation of equivalent control requires prior review and approval by the Executive Director.
 - C. An open-top tank containing a floating roof (external floating roof tank) which uses double seal or secondary seal technology will be an approved control alternative to an internal floating roof tank provided the primary seal consists of either a mechanical shoe seal or a liquid-mounted seal and the secondary seal is rim-mounted. A weather shield is not approvable as a secondary seal unless specifically reviewed and determined to be vapor-tight.
 - D. For any tank equipped with a floating roof, the holder of this permit will follow Title 40

Code of Federal Regulations Part 60.113b (40 CFR 60.113b) Testing and Procedures to verify seal integrity. Additionally, the permit holder will follow 40 CFR 60.115b Reporting and Record keeping Requirements to provide records of the dates seals were inspected, seal integrity, and corrective actions taken.

- E. The floating roof design will incorporate sufficient flotation to conform to the requirements of API Code 650, or an equivalent degree of flotation, except that an internal floating cover need not be designed to meet rainfall support requirements and the materials of construction may be steel or other materials.
- F. Uninsulated tank exterior surfaces exposed to the sun will be white or aluminum.
- G. For purposes of assuring compliance with VOC emission limitations, the holder of this permit will maintain a monthly emissions record that describes calculated emissions of VOC from all storage tanks and loading operations. The record will include a tank or loading point identification number, control method used, tank or vessel capacity in gallons, name of the material stored or loaded, VOC molecular weight, VOC monthly average temperature in degrees Fahrenheit, VOC vapor pressure at the monthly average material temperature in psia, VOC throughput for the previous month and year-to-date. Records of VOC monthly average temperature are not required to be kept for unheated tanks that receive liquids that are at or below ambient temperatures. These records will be maintained at the plant site for at least two years and be made available to representatives of the TNRCC upon request.
- H. If throughput records are specified in the special conditions of this permit, the holder of this permit may keep such records in lieu of the records required in Paragraph G.
- I. Emissions for tanks and loading operations will be calculated using: (a) AP-42 "Compilation of Air Pollution Emission Factors, Chapter 7 Storage of Organic Liquids and Chapter 5.2 Transportation and Marketing of Petroleum Liquids" and (b) the TNRCC publications titled "Technical Guidance Package for Chemical Sources Storage Tanks" and "Technical Guidance Package for Chemical Sources Loading Operations."
- J. Operation without visible liquid leaks or spills will be maintained at all loading/unloading facilities, regardless of vapor pressure. This does not apply to momentary dripping associated with the initial connection or disconnection of fittings. Sustained dripping from fittings during loading/unloading operations is not permitted. Any liquid spill that occurs during loading/unloading activities will be reported as required pursuant to §101.6 or §101.7, and will be cleaned up immediately to minimize air emissions.

FUGITIVE EMISSION MONITORING

13. Piping, Valves, Flanges, Pumps, and Compressors in Volatile Organic Compounds (VOC)

Service - Intensive Directed Maintenance

Except as may be provided for in the special conditions of this permit, the following requirements apply to the above-referenced equipment.

- A. These conditions will not apply (1) where the VOCs have an aggregate partial pressure or vapor pressure of less than 0.044 psia at 68°F or (2) * REMOVE IF SUBJECT TO REG. V * to piping and valves two inches nominal size and smaller, or (3) operating pressure is at least five kilopascals (0.725 psi) below ambient pressure. Equipment excluded from this condition will be identified in a list to be made available upon request.
- B. Construction of new and reworked piping, valves, and pumps and compressor systems will conform to applicable ANSI, API, ASME, or equivalent codes.
- C. New and reworked underground process pipelines will contain no buried valves such that fugitive emission monitoring is rendered impractical.
- D. To the extent that good engineering practice will permit, new and reworked valves and piping connections will be so located to be reasonably accessible for leak-checking during plant operation. Non-accessible valves, as defined by Regulation V, will be identified in a list to be made available upon request.
- E. New and reworked piping connections will be welded or flanged. Screwed connections are permissible only on piping smaller than a two-inch diameter. No later than the next scheduled quarterly monitoring after initial installation or replacement, all new or reworked connections will be gas-tested or hydraulically-tested at no less than normal operating pressure and adjustments made as necessary to obtain leak-free performance. Flanges will be inspected by visual, audible, and/or olfactory means at least weekly by operating personnel walk-through.

Each open-ended valve or line will be equipped with a cap, blind flange, plug, or a second valve. Except during sampling, the second valve will be closed.

F. Accessible valves will be monitored by leak-checking for fugitive emissions at least quarterly using an approved gas analyzer with a directed maintenance program. Sealless/leakless valves (including, but not limited to, welded bonnet bellows and diaphragm valves) and relief valves equipped with a rupture disc upstream or venting to a control device are not required to be monitored. For valves equipped with rupture discs, a pressure gauge will be installed between the relief valve and rupture disc to monitor disc integrity. All leaking discs will be replaced at the earliest opportunity but no later than the next process shutdown.

An approved gas analyzer will conform to requirements listed in Title 40 Code of Federal Regulation Part 60.485(a) - (b).

A directed maintenance program will consist of the repair and maintenance of components assisted simultaneously by using an approved gas analyzer such that a minimum concentration of leaking VOC is obtained for each component being maintained. Replaced components will be monitored again within 15 days of being placed back into VOC service.

- G. Except as may be provided for in the special conditions of this permit, all pump and compressor seals will be monitored with an approved gas analyzer at least quarterly or be equipped with a shaft sealing system that prevents or detects emissions of VOC from the seal. Seal systems designed and operated to prevent emissions or seals equipped with an automatic seal failure detection and alarm system need not be monitored. These seal systems may include (but are not limited to) dual pump seals with barrier fluid at higher pressure than process pressure, seals degassing to vent control systems kept in good working order, or seals equipped with an automatic seal failure detection and alarm system. Submerged pumps or sealless pumps (including but not limited to diaphragm, canned, or magnetic driven pumps) may be used to satisfy the requirements of this condition and need not be monitored.
- H. Damaged or leaking valves or flanges found emitting VOCs in excess of 500 ppmv or found by visual inspection to be leaking (e.g., dripping liquids) will be tagged and replaced or repaired. Damaged or leaking pump and compressor seals found emitting VOC in excess of 2,000 ppmv or found by visual inspection to be leaking (e.g., dripping liquids) will be tagged and replaced or repaired.
- I. Every reasonable effort will be made to repair a leaking component, as specified in this paragraph, within 15 days after the leak is found. If the repair of a component would require a unit shutdown, the repair may be delayed until the next scheduled shutdown. All leaking components that cannot be repaired until a scheduled shutdown will be identified for such repair by tagging. The Executive Director, at his discretion, may require early unit shutdown or other appropriate action based on the number and severity of tagged leaks awaiting shutdown.
- J. The results of the required fugitive monitoring and maintenance program will be made available to the Executive Director or his designated representative upon request. Records will show appropriate dates, test methods, instrument readings, repair results, and corrective actions taken for all components. Records of flange inspections are not required unless a leak is detected.
- K. Alternative monitoring frequency schedules ("skip options") of Texas Natural Resource Conservation Commission (TNRCC) Rules and Regulations, 30 Texas Administrative Code §115 (commonly known as Regulation V) or Hazardous Organic National Emission Standards for Hazardous Air Pollutants may be used instead of Items F through G of this condition. Compliance with the requirements of this condition does not assure compliance with requirements of TNRCC Regulation V, an applicable New Source Performance Standard or an applicable NESHAPS and does not constitute approval of alternative standards for these regulations.

14. Safety valves listed below that discharge to the atmosphere only as a result of fire or failure of utilities (or decomposition reactions, for high pressure processes) are exempt from Special Condition No. 4, provided each valve in VOC service is equipped with a rupture disc upstream. A pressure gauge will be installed between the relief valve and rupture disc to monitor disc integrity. All leaking discs will be replaced at the earliest opportunity but no later than the next process shutdown. Any release to the atmosphere occurring as a result of any safety relief valve(s) lifting will be reported as provided under TNRCC General Rules. The safety valves below are covered by this condition:

SV -# SV-# Valves are listed individually.

INITIAL DEMONSTRATION OF COMPLIANCE

- 15. Sampling ports and platform(s) will be incorporated into the design of the stack (EPNs extruder/dryer, silo, and loading) according to the specifications set forth in the attachment entitled "Chapter 2, Stack Sampling Facilities." Alternate sampling facility designs may be submitted for approval by the Regional Manager or the Manager of the Source and Mobile Monitoring Section.
- 16. The holder of this permit will perform stack sampling and other testing to establish the actual pattern and quantities of air contaminants being emitted into the atmosphere. At a minimum, the stack sampling will be conducted on the Extruder/Dryer Vent (EPN extruder/dryer), Silo Vent (EPN silo), and Loading (EPN loading). The holder of this permit is responsible for providing sampling and testing facilities and conducting the sampling and testing operations at his expense.
 - A. The appropriate TNRCC regional office in the region where the source is located will be contacted as soon as testing is scheduled, but not less than 45 days prior to sampling to schedule a pretest meeting.

The notice will include:

- (1) Date for pretest meeting.
- (2) Date sampling will occur.
- (3) Name of firm conducting sampling.
- (4) Type of sampling equipment to be used.
- (5) Method or procedure to be used in sampling.

The purpose of the pretest meeting is to review the necessary sampling and testing procedures, to provide the proper data forms for recording pertinent data, and to review the format procedures for submitting the test reports.

A written proposed description of any deviation from sampling procedures specified in permit provisions or TNRCC or Environmental Protection Agency (EPA) sampling procedures will be made available to the TNRCC before the pretest meeting. The TNRCC Regional Manager or the Manager of Engineering Services Section will approve or disapprove of any deviation from specified sampling procedures.

Requests to waive testing for any pollutant specified in B of this provision will be submitted to the TNRCC Office of Air Quality New Source Review Program. Test waivers and alternate/equivalent procedure proposals for New Source Performance Standard (NSPS) testing which must have EPA approval will be submitted to the TNRCC Austin Office of the Air Quality Enforcement Division, Engineering Services Section.

- B. Air contaminants to be tested for include (but are not limited to) VOCs (this may be speciated if impacts are a concern).
- C. Sampling will occur within 60 days after achieving the maximum production rate, but not later than 180 days after initial startup (or production increase approved by this amendment action) of the facilities (or within 120 days of approval of this permit amendment if little construction required) and at such other times as may be required by the Executive Director of the TNRCC. Requests for additional time to perform sampling will be submitted to the regional office. Additional time to comply with the applicable requirements of 40 CFR 60 and 40 CFR 61 requires EPA approval, and requests will be submitted to the TNRCC Austin Office of the Air Quality Enforcement Division, Engineering Services Section.
- D. The plant will operate at maximum production rates during stack emission testing. Primary operating parameters that enable determination of a production rate will be monitored and recorded during the stack test. These parameters are to be determined at the pretest meeting. If the plant is unable to operate at maximum rates during testing, then future production rates may be limited to the rates established during testing. Additional stack testing may be required when higher production rates are achieved.
- E. Three copies of the final sampling report will be forwarded to the TNRCC within 60 days after sampling is completed. Sampling reports will comply with the attached provisions of Chapter 14 of the TNRCC <u>Sampling Procedures Manual</u>. The reports will be distributed as follows:

One copy to the TNRCC regional office.

One copy to *local program*.

One copy to the TNRCC Austin Office of the Air Quality Enforcement Division, Engineering Services Section.

CONTINUOUS DEMONSTRATION OF COMPLIANCE

17. Ongoing compliance with VOC emission limits for the polyethylene pellet handling systems between the extruder and hopper car loading areas will be determined by calculation using weekly production rates and weekly average sampling and testing of the polyethylene for residual VOC at the following two locations: (A) immediately before the pellet extruder and (B) immediately before final product loading. The VOC head space test or an equivalent approved by the TNRCC Austin Office of the Air Quality Enforcement Division, Engineering Services Section will be used to determine the residual VOC. Weekly average sampling will be based on a minimum of three samples.

Polymer production rates and monitoring records will be maintained at the plant site for at least the last two years and made available upon request to TNRCC personnel. The compliance records will include (but are not limited to):

- A. Date and time of sample.
- B. Actual plant production rate at the time of sampling and weekly average production rates.
- C. Product number and melt index.
- D. Measured total VOC concentration of polymer at the extruder (A) and before the final product is shipped (B).
- E. Polymer handling emissions will be calculated by (A B) multiplied by (weekly production rate). Calculations will take into account any changes in product type during the week.

Sampling will begin no later than 60 days after initial start-up of each reactor train. Sampling and testing will be performed with methods approved by the TNRCC regional office.

RECORD KEEPING REQUIREMENTS

- 18. Facility records will show the following:
 - A. Throughput for high density polyethylene in million (MM) pounds on a weekly basis.
 - B. Results of cooling tower water monitoring recorded on a monthly basis.
 - C. Sampling results for VOC emissions between the extruder and hopper car loading areas. These records will include:
 - (1) Date and time of sample.
 - (2) Type of product produced (i.e., product number or grade.

- (3) Weekly production quantity (MM lb.s. of product).
- (4) Measured VOC concentration (lb.s. per MM lbs. of product) in polyethylene at two locations: (A) immediately before the extruder and (B) immediately before product hopper car loading areas. Total VOCs emitted to the atmosphere between points (A) and (B) will be calculated by (A-B). This record will be used to demonstrate compliance with Special Conditions Numbers 1 and 8.
- D. Records required by Special Conditions Numbers 6, 12, and 13.

The facility records will be maintained on-site in a current and complete condition and will be made available upon request to representatives of the TNRCC. All records will be retained for at least two years from the date upon which they were made.

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VIII. RELATED RESOURCES

State regulations, especially Regulations I, V, and VI.

Federal NSPS Subparts A, VV, DDD

Polymer Manufacturing Industry - Enabling Document, EPA-450/3-90-019, December 1990.

TNRCC Standardization Packages: Equipment Leak Fugitives

Cooling Towers
Storage Tanks
Flare Sources
Boilers/Heaters
Loading Operations

New Source Review Workshop Manual

Nonattainment New Source Review Guidance Manual